General Biology I (101-NYA)
Cells Concepts & Learning Outcomes

Topic	Chapter 1, 5 & 6 pages*	Concept	Learning Outcomes
Cell theory	p. 2	1. Cell theory: a. Every organism is composed of one or more cells. b. The cell is the smallest unit having properties of life. c. All cells come from preexisting cells. d. Continuity of life arises from growth and division of single cells.	1. State the cell theory and describe its implications for biological sciences
Cell size		2. Most cells are tiny, with diameters in the range of 1 to 100 μm. 3. Cell size is limited by the surface area-to-volume ratio. 4. Shape influences surface area-to-volume ratios.	2. Explain what is meant by surface area-to-volume ratio and explain the importance of this ratio in determining cell size 3. Explain the relationship between cell size and homeostasis
Types of cells		5. There are 2 major categories of cells, based on where, within the cell, most of the genetic material is stored: a. Prokaryotic cells: no nucleus or other membrane-bounded compartments; Bacteria & Archaea b. Eukaryotic cells: membrane-bounded nucleus and compartments or organelles; Eukarya	4. Compare and contrast prokaryotic and eukaryotic cells
Prokaryotic cells	p. 112-115	6. The main components of prokaryotic cells include: a. Plasma membrane (phospholipid bilayer) b. Cytoplasm: highly concentrated solution of all the molecules that make up the inside of the cell; supercoiled circular chromosome found in the nucleoid region c. Cell wall: protects cells and gives them shape and structure	5. Provide a rough description of the main structures of prokaryotic cells
Eukaryotic cells	p. 116-125	7. The larger size of the eukaryotic cell makes it difficult for molecules to diffuse across the entire cell. This is partially solved by membrane-bound organelles.	6. Provide a rough description of the main structures and organelles, and their main functions, of eukaryotic cells

		8. The main organelles of eukaryotic cells include: a. Nucleus: contains most of the cell's genetic material (DNA) b. Mitochondria and chloroplasts: power plant and industrial park for the storage and conversion of energy c. Endoplasmic reticulum and Golgi apparatus: protein packaging and transportation d. Lysosomes: cellular digestive systems e. Vacuoles: water and/or ion storage (water, ions, other compounds); help the cell maintain its normal volume (turgid pressure); waste storage ; digestive functions; found in plant cells and some fungi and protista 9. Eukaryotic cells contain cytoskeletal proteins: maintain cell shape, support, intracellular movement (trafficking of materials within the cell), and cellular movement.	7. Differentiate between plant and animal cells
Nucleus	p. 127-129	10. It is one of the largest organelle in the cell. 11. It is surrounded by the nuclear envelop (double membrane consisting of 2 lipid bilayers and nuclear pores) as and contains: a. Nucleolus: non-membrane-bounded region; assembly of ribosomes b. Chromatin fibers: long thin fibers of DNA bound to proteins c. RNA d. Nucleoplasm: nuclear matrix	8. Describe the structure and function of the nucleus
Vacuoles & peroxisomes	p. 120-121; 123	12. Vacuoles are large lysosomes found in plant cells and some fungal and protistan cells. 13. Peroxisomes are small globular organelles where oxidation reactions occur (H_2O_2 produced as a byproduct of metabolism is converted to H_2O and O_2 by the enzyme catalase)	9. State the type of cells that contain vacuoles and peroxisomes and describe the structure and function of these organelles
Mitochondria	p. 123-124	14. Mitochondria are organelles that are involved in converting the potential energy of fuel molecules into a form that the cell can use (ATP). 15. Mitochondria can divide independently of cell division. 16. A typical mitochondrion consists of the following structures: a. Outer lipid bilayer b. Highly folded inner lipid bilayer (cristae): site of ATP production c. Matrix where small amount of DNA and some ribosomes are located	10. Provide a rough description of the structure of mitochondria and describe the role they play in energy conversions
Plastids	p. 124	17. Plastids are found in plants and algae (protists). Several types exit: a. Chloroplasts: convert light energy into chemical energy (photosynthesis); consist of a double membrane, thylakoid network (where chlorophyll and other pigments for photosynthesis are	11. Define plastids and give examples of the different types that exist in some eukaryotic cells 12. Provide a rough description of the

		embedded), stroma (intermembrane space) where small amount of DNA and some ribosomes are located b. Chromoplasts: pigment storage c. Leucoplast: starch and fat storage 18. Chloroplasts can divide independently of cell division.	structure of chloroplasts and describe the role they play in energy conversions 13. Compare and contrast the structure and function of mitochondria and chloroplasts
Cytoskeleton	p. 134-140	19. There are 3 major types of cytoskeletal components: a. Microfilaments (actin filaments): made up of the protein actin; fiber diameter = 7 nm; function in cell movement, cell support & cell shape b. Intermediate filaments: diameter = 8-10 nm; made up of tough protein fibers; function in cell support c. Microtubules: diameter = 25 nm; made up of the protein tubulin; function in cell division (movement of chromosomes) & movement of vesicles (role of motor proteins & ATP, and microtubules acting as tracks for vesicular movement) 20. Microtubules are also found in: a. Centrosome: consists of 2 centrioles; involved in cell division b. Cilia and flagella: locomotary cellular appendages consisting of plasma membrane-covered microtubules	14. Define cytoskeleton and describe the structure and function of the 3 major types of cytoskeletal proteins 15. Compare and contrast cilia and flagella and describe their functions
Endomembrane system	p. 129-134	21. It is the primary centre for protein and lipid synthesis in the cell. It also acts as a centre for processing and transport of proteins within and outside of the cell. 22. It consists of 3 main parts: a. Endoplasmic reticulum (ER) b. Golgi apparatus c. Lysosomes 23. The endoplasmic reticulum is a nnetwork of interconnecting membranes distributed throughout the cytoplasm and is continuous with the nuclear envelop. It exists under 2 forms: a. Rough ER: ribosomes attached on the surface, which actively synthesize proteins b. Smooth ER: ribosome-free region; synthesis and hydrolysis of glycogen (animal starch), drug detoxification (including alcohol) & cholesterol and steroid synthesis 24. The Golgi apparatus consists of membrane-bounded compartments known as cisternae (stacked like pancakes; cis, middle, and trans regions); functions in protein processing and sorting via vesicular trafficking (receives products from the rough ER and sends finished products to the	16. Provide a rough description of the endomembrane system 17. Distinguish between smooth and rough endoplasmic reticulum in terms of structure and function 18. Trace the path of a protein as it is synthesized in the rough ER and processed in the Golgi apparatus 19. Describe the function of lysosomes 20. Define endocytosis

		cell surface in vesicles) 25. Lysosomes originate from vesicles that bud off from the Golgi apparatus; contain digestive enzymes and are involved in the formation of phagosomes. 26. Materials are delivered to lysosomes via endocytosis (phagocytosis, pinocytosis, receptor-mediated endocytosis, and autophagy)	
Plasma membrane (and other biological membranes): fluid mosaic model	p.99-101	27. The fluid mosaic model of the plasma membrane: membrane structure where some proteins are inserted into the lipid bilayer, making the membrane a fluid, dynamic mosaic of phospholipids and proteins. 28. The main components of the plasma membrane: a. Lipid portion: phospholipid bilayer and other lipids (eg, cholesterol); selectively permeable barrier for molecules; physical integrity of the membrane b. Protein portion: embedded in the lipid bilayer; variety of functions (eg, receptors for cell-cell communication, ion channels, transport of molecules) c. Carbohydrate portion: oligosaccharides attached to lipid or protein molecules on the outer surface of the membrane; function in cell identity and cell-cell communication	21. Describe the fluid mosaic model of plasma membrane structure 22. Compare and contrast the function of the different components of the plasma membrane 23. Describe why biological membranes are selectively permeable, and what factors affect their permeability 24. Describe what kinds of molecules are able to diffuse freely through biological membranes, and what molecules can only do so with assistance